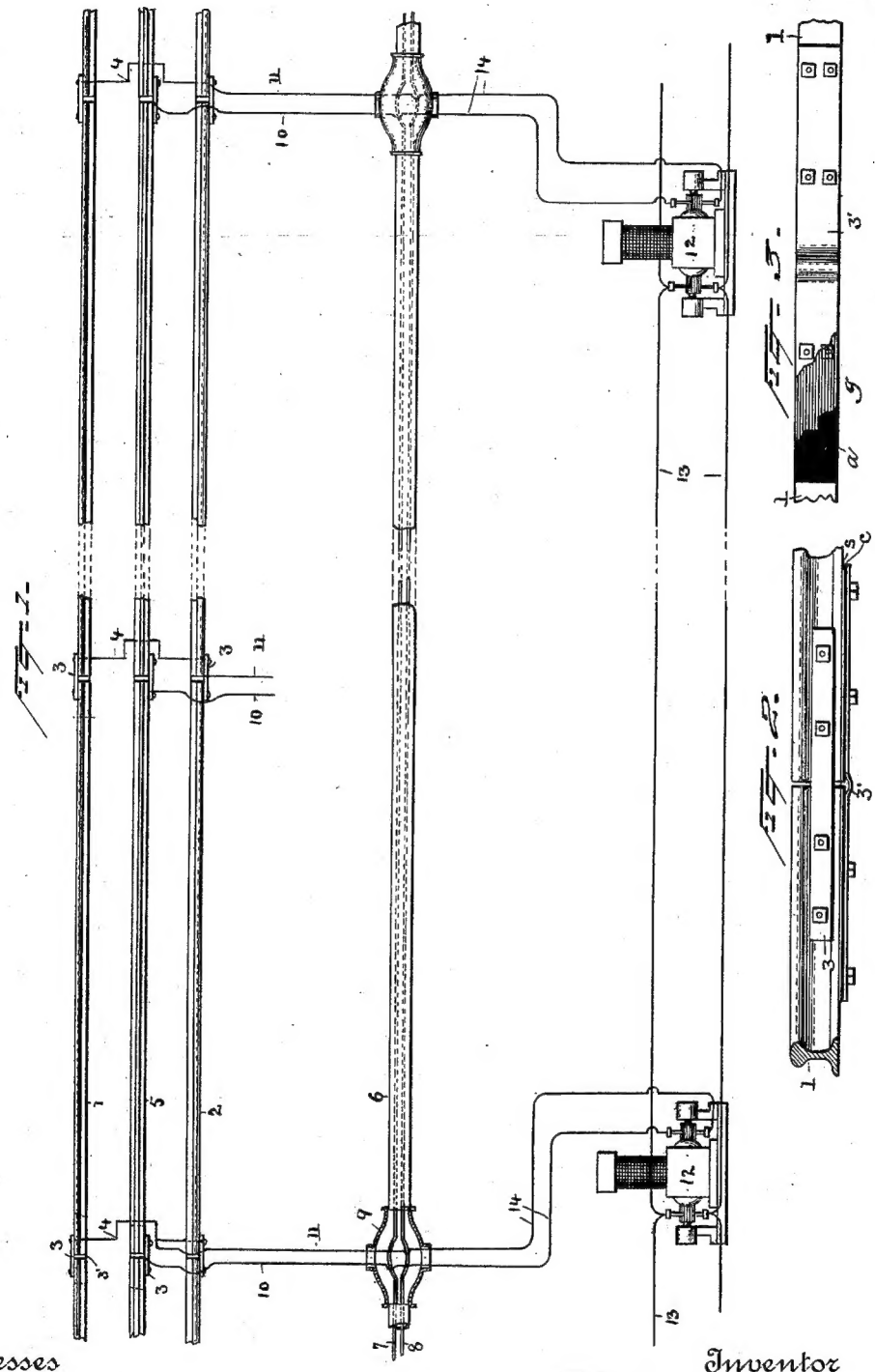
(No Model.)

T. A. EDISON.

ELECTRIC RAILWAY.

No. 509,518. Patented Nov. 28, 1893.



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ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 509,518, dated November 28, 1893.

Application filed August 14, 1891. Renewed June 2, 1893. Serial No. 476,395. (No model.)

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, a citizen of the United States, residing at Llewellyn Park, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Electric Railways, (Case No. 919,) of which the following is a specification.

This invention relates to railway systems employing current of low tension for driving the electrical motors, and the main object is to provide a system of conductors having as little resistance as practicable, and the invention consists in the system, and in the several combinations hereinafter described and claimed.

In the drawings, Figure 1 is a diagrammatic view representing a short section of the system; and Figs. 2 and 3 are views showing the construction of the rail joint, applied to T rails instead of the form indicated in Fig. 1.

In my patent No. 468,949, dated February 16, 1892, I have described a system of electric railways in which a high tension circuit is led along the track, and at intervals is connected to an apparatus for reducing the voltage of the current. At these points conductors carrying low pressure current are connected to the working conductors. I have found that the voltage in conductors placed at the surface of the street must not materially exceed twenty-five volts, since a higher voltage is liable to affect horses coming in contact with the conductors. The employment of such low tension current necessitates the use of current of great quantity. Hence resistances which would not be of any consequence in high tension systems such as the usual trolley systems, are fatal to the low tension system. The usual rails, even if the joints were perfect, have quite an insufficiency of metal to carry the required current for any considerable distance without great loss, but the joints are the source of the greatest resistance and large copper bands or strips connecting the rails prove inadequate to sufficiently reduce the resistance. To overcome the difficulty above mentioned I have designed the present improved joint and system.

The track consists of two lines of rails 1, 2, the meeting ends of which are connected by the usual fish-plates 3, and by strips, plates or rods 3′ of good conductivity, preferably of copper. The rail is brightened and then amalgamated by rubbing on sodium amalgam indicated at *s* Fig. 2. The copper is also amalgamated. Then before bolting the joints together a quantity of amalgam *c* somewhat thinner than dough is put between the two surfaces and the two bolted together. The amalgam soon hardens. The joint so formed is surprisingly perfect. The joints so formed are coated with marine glue or similar compound *g* and then asphalted, as indicated at *a* Fig. 3. The joint described is useful with other arrangements of the conductors than that shown herein; for example, those systems in which the working rails form the two sides of the circuit, and the car wheels on the two sides of the car are insulated from each other. The wires leading to the junction boxes are also roughly insulated, not so much to prevent leakage as to prevent destruction of the copper by electrolytic action. Between the rails 1, 2, and preferably extending from the joints or directly from the rails near the joints, are cross conductors 4, one such conductor being placed at each joint in the rails. The two lines of rails 1, 2 connected end to end and cross connected as described, constitute one side of the working circuit. The other working conductor may consist of a central rail 5, the sections of which are also connected by copper strips 3′ about as wide as the bases of the rails, and placed under the same. Along the track is placed a tube 6, preferably buried in the ground and carrying two large copper insulated conductors 7, 8, forming a low tension supply circuit. The supply circuit receiving the current direct from all the converter secondary circuits and connected to the working conductors at frequent intervals reduces the resistance of the system and tends to lessen any trouble which might arise from imperfect rail joints. The tubes and conductors are made in sections, approximately twenty feet long, and are connected by junction boxes 9 in substantially the same manner as in my electric lighting system. From one of the conductors for example, 8, a conductor 10 extends to the working conductor 5; while from the other conductor 7 a conductor 11 extends to the rails 1, 2. This conductor may be connected directly to one of the rails, or it may

be connected to the cross wire 4. Conductors 10, 11 connect the supply circuit to the working circuit at each joint of the rails.

At intervals of every thousand feet more or less according to the amount of traffic is placed a source of low tension current, shown in the drawings as motor generators, 12, having their primary or high tension windings connected in multiple arc to the high tension circuit 13 extending to any suitable generator. The low tension circuits 14 are connected to the supply conductors at suitable junction boxes, as indicated in the drawings.

With the arrangement of circuits set forth an occasional imperfect joint would have practically no bad effect on the system, since the cross connections, and the numerous connections with the supply circuit, furnish abundant means for passage of the necessary current. By reinforcing the current in the supply circuit at intervals, the desired current is maintained in the circuit. With this arrangement of conductors a current can be used of potential lower than has heretofore been practicable.

What I claim is—

1. The combination, in an electric railway, of a high tension circuit, tension reducing converters having their primary circuits connected thereto at intervals, a continuous supply circuit extending along the line of the railway, with which the secondary circuits of said converters are connected at intervals, and working conductors connected at intervals to said supplying circuit, substantially as set forth.

2. The combination, in an electric railway, of a high tension circuit, tension reducing converters, having their primary circuits connected thereto at intervals, a continuous supply circuit extending along the line of the railway, with which the secondary circuits of said converters are connected at intervals, and working conductors connected at intervals to said supplying circuit, one of said working conductors consisting of the two lines of rails of the track, the rails of each line being electrically connected end to end, and the two lines of rails being cross-connected at frequent intervals, substantially as set forth.

3. The combination with two rails forming part of an electric circuit, of a metal conductor attached rigidly to the meeting ends of said rails, and a layer of conducting amalgam between said conductor and the rails, substantially as set forth.

4. The combination with two rails forming part of an electric circuit, of a flat metal plate or strip laid against said rails at their meeting ends and rigidly secured thereto, and a layer of conducting amalgam between said plate and said rails, substantially as set forth.

5. The combination with conducting rails, of a metal conductor joining them, a layer of sodium amalgam and a layer of copper amalgam between said rails and conductor, substantially as described.

6. The combination of conducting rails, a bent metal plate connecting them, and a conducting amalgam between the rails and plate, substantially as described.

7. The combination of conducting rails, a metal plate connecting them, said plate being placed under the bases of the rails, and a conducting amalgam between the rails and plate, substantially as described.

8. The combination of conducting rails, a metal plate connecting them, said plate being about as wide as the bases of the rails and being placed under said bases, substantially as described.

9. The combination with conducting rails, a conductor joining them, and a coating of water-proof material over the joint, substantially as described.

10. The combination, with conducting rails, a conductor joining them, a conducting amalgam between the rails and conductor, and a coating of water-proof material over the joint, substantially as described.

This specification signed and witnessed this 31st day of July, 1891.

THOS. A. EDISON.

Witnesses:
JOHN F. RANDOLPH,
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